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A SURVEY OF INTERNAL PARASITES OF BIRDS ON THE WESTERN SLOPES OF DIAMOND HEAD, OAHU, HAWAII 1972-1973

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ABSTRACT

A survey of the internal parasites present in 21 species of birds in the Diamond Head area on Oahu was conducted during 1972-1973. A total of 121 birds were examined for protozoa and helminth infections. Twenty individuals were infected with protozoa and 40 with helminths. Forty of these birds were also examined for internal mites; seven were infected.

Each type of parasite is discussed and its history in Hawaii. First records of parasites in Hawaii include Syngamus trachea taken from a Red-crested Cardinal; Capillaria sp. from a Cordon-bleu, Orange-cheeked Waxbill, and two Cardinals; Plagiorhynchus charadrii from a Golden Plover; Mediorhynchus orientalis from a Common Mynah, Cardinal, and two Red-crested Cardinals; and Sternostoma tracheacolum from a Cordon-bleu and Red-eared Waxbill.

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INTRODUCTION

Records of internal parasites recovered from wild birds in Hawaii are sparse. Alicata (1964) summarized earlier research, and since that time there has been little work in this area with the exception of Lewin and Holmes (1971). This study was undertaken to determine the types of internal parasites present in 21 species of birds (18 introduced Passeriformes; two introduced Columbiformes; one indigenous Charadriiformes) on the western slopes of Diamond Head, Oahu. Sampling extended from August 1972 through December 1973.

The Diamond Head area is relatively low and arid, and the vegetation consists predominantly of introduced plants such as Haole Koa (Leucaena leucocephala) and Kiawe (Prosopis pallida). The avian community is unique on Oahu, including a variety of escaped cage birds (accidentially or intentionally released). Most of these species have been reported since 1965 in the Hawaii Audubon Society Christmas Bird Counts (Table 1). The only other area in the state with a similiar assemblage of recently introduced birds is located on the Puuwaawaa Ranch on the island of Hawaii (Berger 1972). Whether these birds are established in either locality is not known, but several species probably are reproducing in the wild. Besides the recently escaped or released cage birds there are introduced doves and passerine birds plus the Golden Plover (Pluvialis dominica).

The introduced birds (and their parasitic fauna) originate in diverse parts of the world (Table 1). Pet store birds have not, in the past, been subject to quarantine regulations and it is probable that some parasites have been introduced to Hawaii via these birds.

Table 1

Birds Observed in the Diamond Head Area (1972-1973)*

Scientific Name	Common Name	Origin	First Recorded in Hawaii	Number of Birds Examined
CHARADRIIDAE				
Pluvialis dominica	Golden Plover	Indigenous	----------	1**
COLUMBIDAE				
Geopelia striata	Barred Dove	Malaysia, Australia	1922	11
Streptopelia chinensis	Lace-necked Dove	East Asia	Before 1900	3
MIMIDAE				
Mimus polyglottos	Mockingbird	N. America	1928	5
STURNIDAE				
Acridotheres tristis	Common Mynah	India	1865	1****
ZOSTEROPIDAE				
Zosterops japonica	White-eye	Japan	1929	6
PLOCEIDAE (Carduelinae)				
Carpodacus mexicanus	Linnet	N. America	Before 1870	12
Serinus mozambicus	Green Singing Finch	Africa	1965	2
PLOCEIDAE (Estrildinae)				
Estrilda caerulescens	Lavender Finch	W. Africa	1965	16
Estrilda melpoda	Orange-cheeked Waxbill	W. & Cent. Africa	1965	11
Estrilda troglodytes	Red-eared Waxbill	Africa	1965	2
Lonchura punctulata	Ricebird	Malaysia	1865	2
Padda oryzivora	Java Sparrow	Java, Malaysia	1865;1969***	1

Table 1 (cont.)

Scientific Name	Common Name	Origin	First Recorded in Hawaii	Number of Birds Examined
Uraeginthus angolensis	Cordon-bleu	W. Africa	1965	5
Uraeginthus bengalus	Red-cheeked Cordon-bleu	Africa	1972	3
Uraeginthus cyanocephala	Blue-headed Cordon-bleu	Africa	1969	3
PLOCEIDAE (Passerinae)				
Passer domesticus	House Sparrow	Europe	1871	3****
PLOCEIDAE (Ploceinae)				
Euplectes orix	Orange Bishopbird	Africa	1965	1
FRINGILLIDAE				
Cardinalis cardinalis	Cardinal	N. America	1929	12
Paroaria coronata	Red-crested Cardinal	S. America	1928	18
Sicalis flaveola	Saffron Finch	S. America	1967	3

*Scientific names follow Berger (1972); origin and first records in Hawaii from Berger (1972) and Caum (1933).

**The Golden Plover examined was taken from Bellows Air Force Station; the species is common in the Diamond Head area during the winter months.

***Java Sparrows were introduced in 1865 but failed to become established; they were reintroduced in 1969.

****The House Sparrows and Common Mynah were taken from the University of Hawaii Manoa campus; both species are common in the Diamond Head area.

METHODS

Birds were obtained in mist nets, wire trip-traps, or shot. Fecal smears were examined from each bird (20 minutes on low power and 15 minutes on high dry power). Necropsies were limited to a few birds with positive fecal samples or those appearing ill. All birds were checked for eyeworm.

Specimens were obtained on the western slopes of Diamond Head unless otherwise stated in Table 1 (several species were taken from the University of Hawaii Manoa campus or Bellows Air Force Station). Birds not killed were banded and released at the site of capture.

Cestodes and acanthocephalans were fixed in standard Formalin-Acetic-Alcohol solution; nematodes were fixed in hot Glycerine-Alcohol solution. Mites were mounted in Hoyer's mounting medium and cleared at 40°C for one week. Most of the specimens were sent to qualified parasitologists for identification; some were identified to genus by H. Eddie Smith.

Ectoparasites and blood samples were collected from many birds; these will be analyzed for publication at a later time.

RESULTS

One hundred and twenty-one birds of 21 species were examined for protozoa and helminth infections; 40 of these birds (17 species) were also examined for internal mites. Twenty individuals (10 species) were infected with protozoa, 40 individuals (13 species) with helminths, and seven individuals (six species) with internal mites.

Protozoa

1. Coccidia. Coccidia were not identified beyond subclass. Nineteen individuals in nine different species were infected (Table 2). None seemed to be in overtly poor health. Alicata (1964) reported coccidia in domestic chickens and Guest (1973) reported coccidia in White-eyes, in Hawaii.

2. Trichomonas. There are several nonpathogenic trichomonads and one pathogenic species that invade avian hosts (Kocan and Herman 1971). Trichomonas was found in epithelial scrapings of the esophagus and crop of one Ricebird that died in an aviary. T. gallinae, a pathogenic species, has been reported in estrildine finches (Petrak 1969) and was reported in the Common Pigeon (Columba livia) in Hawaii by Yager and Gleiser (1946).

Table 2

Incidence of Protozoa in Birds Examined *

	No. with Coccidia	No. with Trichomonas	No. Examined
Golden Plover			1
Barred Dove	5		11
Lace-necked Dove			3
Mockingbird	1		5
Common Mynah			1
White-eye			6
Linnet	2		12
Green Singing Finch			2
Lavender Finch	2		16
Orange-cheeked Waxbill	1		11
Red-eared Waxbill			2
Ricebird		1	2
Java Sparrow			1
Cordon-bleu	1		5
Red-cheeked Cordon-bleu	1		3
Blue-headed Cordon-bleu			3
House Sparrow	2		3
Orange Bishopbird			1
Cardinal			12
Red-crested Cardinal	4		18
Saffron Finch			3

*Numbers indicate the number of individual birds.

Nematoda

1. Oxyspirura mansoni. This eyeworm utilizes as an intermediate host, the cockroach Pycnoscelus surinamensis (Schwabe 1951). Heavy infections create a great deal of irritation which may cause the birds to scratch and thereby injure the eyeball (Schwabe 1950). It has been reported in Hawaii from the California Quail (Lophortyx californicus), Barbary Partridge (Alectoris barbara), Bare-throated Francolin (Pternistis leucoscepus), Gray Francolin (Francolinus pondicerianus; Lewin and Holmes 1971), Japanese Quail (Coturnix coturnix; Schwartz and Schwartz 1949), domestic chicken (Alicata 1936), Turkey (Meleagris gallopavo; Lewin and Holmes 1971), Lace-necked Dove (Schwartz and Schwartz 1949), Chinese Ring-necked Pheasant (Phasianus colchicus; Lewin and Holmes 1971, Schwartz and Schwartz 1949, Swanson 1939), Common Mynah (Eddinger 1967), House Sparrow (Illingworth 1931), Red-crested Cardinal (Berger 1972). In this study it was found in the Lace-necked Dove, Barred Dove, and Red-crested Cardinal.

2. Syngamus trachea. S. trachea was first reported in Hawaii from a juvenile Red-crested Cardinal taken during the early part of this study (Smith 1973a). It was later found in a juvenile Linnet. Petrak (1969) reported that this is the only species of gapeworm likely to be encountered in passerines and it usually affects young birds; heavy infections may cause death. It infects a great number of bird species throughout the world. The intermediate host in Hawaii is not known, but earthworms, slugs, and snails serve as intermediate hosts elsewhere.

3. Capillaria. Nematodes of this genus may or may not utilize an intermediate host and some may be very pathogenic (Wehr 1971). Very little is known about the incidence of Capillaria in cage and aviary

birds but many species have been reported from poultry and wild birds (Petrak 1969). Capillaria was present in the Cordon-bleu, Orange-cheeked Waxbill, and Cardinal. This genus has not been reported in birds from Hawaii before.

4. Dispharynx. In Hawaii D. nasuta infects chickens, with the sow bug (Porcellio laevis) serving as intermediate host (Alicata 1964). Lewin and Holmes (1971) found Dispharynx in the Barbary Partridge and California Quail. D. nasuta also is known to infect passerine birds (Goble and Kutz 1945). Many workers consider this parasite to be an important pathogen (Wehr 1971). In this study Dispharynx was found in the Mynah, Cardinal, and Red-crested Cardinal.

5. Tetrameres. Kartman (1951) reported Tetrameres in the House Sparrow and Alicata (1964) reported T. americanus from chickens in Hawaii. Tetrameres was observed in the proventriculus of the Red-crested Cardinal and Lavender Finch in this study. Two species of grasshoppers (Conocephalus saltator and Oxya chinensis) in Hawaii may serve as intermediate hosts (Kartman 1951). According to LaPage (1956), the adults of T. americanus may have a toxic effect; juvenile worms cause mechanical damage while migrating to the proventriculus; young birds seem to be more severly affected.

6. Microtetrameres. This genus was reported from the Common Mynah in Hawaii by Alicata, Kartman, and Fisher (1948). It requires an intermediate host, but the host in Hawaii is unknown. Microtetrameres has been reported in 10 orders of birds throughout the world (Ellis 1969). Pathogenic effects are mainly mechanical damage (Ellis 1970). It was found in the Common Mynah and White-eye in this study.

7. Unidentified nematode ova. During the fecal examinations, nematode ova were sometimes seen that were not preserved or identified, and the host was not killed to recover the adult parasite. This occurred in the Barred Dove, Mynah, Linnet, Cordon-bleu, Orange-cheeked Waxbill, Cardinal, and Red-crested Cardinal.

Acanthocephala

Two species of acanthocephalans were found in this study; both are first reports for Hawaii: Plagiorhynchus charadrii from a Golden Plover (bird collected at Bellows A.F.S.) and Mediorhynchus sp. (probably M. orientalis; Schmidt 1973) from the Mynah, Red-crested Cardinal, and Cardinal. P. charadrii is normally found in plovers and has been reported from the Kentish Plover (Charadrius alexandrinus nihonensis), Little Ringed Plover (C. dubis curonicus), and the Golden Plover (Schmidt and Kuntz 1966). The intermediate hosts in Hawaii are not known, but acanthocephalans affecting passerine birds typically utilize annelids and terrestial insects (Petrak 1969).

Cestoda

The tapeworms recovered are pending identification. Many cestodes have been reported from birds in Hawaii (Alicata 1964), and they utilize a variety of intermediate hosts. Tapeworms were found in the Lace-necked Dove, Common Mynah, House Sparrow, Lavender Finch, Red-cheeked Cordon-bleu, and Red-crested Cardinal.

Table 3

Helminths in Birds Examined*

	Oxyspirura mansoni	*Syngamus trachea*	*Capillaria*	*Dispharynx*	*Tetrameres*	*Microtetrameres*	Unidentified Nematode Ova	*Plagiorhynchus charadrii*	*Mediorhynchus orientalis*	Cestoda	No. Examined
Golden Plover								1			1
Barred Dove	1						2				11
Lace-necked Dove	1									1	3
Mockingbird											5
Common Mynah**				1		1	1		1	2	1
White-eye						1					6
Linnet		1					2				12
Green Singing Finch											2
Lavender Finch					1					1	16
Orange-cheeked Waxbill			1				1				11
Red-eared Waxbill											2
Ricebird											2
Java Sparrow											1
Cordon-bleu			1				1				5
Red-cheeked Cordon-bleu										1	3
Blue-headed Cordon-bleu											3
House Sparrow										2	3
Orange Bishopbird											1
Cardinal			2	1			1		1		12
Red-crested Cardinal	2	1		1	2		1		2	1	18
Saffron Finch											3

*Numbers indicate number of individual birds.

**The mynah was found dead on campus and had two different types of cestodes.

Internal Mites

Two types of internal mites were discovered, both belonging to the family Rhinonyssidae. Sternostoma tracheacolum was first reported in Hawaii from a Cordon-bleu and Red-eared Waxbill during this study (Smith 1973b). It was later found in the respiratory tract of another Cordon-bleu and in the body cavity of an Orange-cheeked Waxbill. S. tracheacolum has a wide distribution throughout the world and is found in many species of birds, including representatives of nine passerine families; it can produce severe respiratory inflamation (Fain and Hyland 1962).

Mites belonging to the genus Ptilonyssus were found in the nasal cavities of a White-eye, Lavender Finch, and Red-crested Cardinal. This group of mites normally inhabits the nasal cavities; the group is found in a wide variety of birds throughout the world. They too can cause respiratory inflamation.

Table 4

Internal Mites in Birds Examined*

	Ptilonyssus	Sternostoma tracheacolum	No. Examined
Golden Plover			1
Barred Dove			3
Lace-necked Dove			1
Mockingbird			1
Common Mynah			1
White-eye	1		1
Linnet			3
Lavender Finch	1		6
Orange-cheeked Waxbill		1	4
Red-eared Waxbill		1	1
Ricebird			1
Java Sparrow			1
Cordon-bleu		2	3
Red-cheeked Cordon-bleu			3
House Sparrow			2
Cardinal			3
Red-crested Cardinal	1		5

*Numbers indicate the number of individual birds infected with a type of parasite or examined. The sample size includes only those birds examined by necropsy.

DISCUSSION

The need for further research on internal parasites in Hawaiian birds is evident from the number of first records discovered in this survey. First reports of parasites in Hawaii include: Syngamus trachea (Smith 1973a); Plagiorhynchus charadrii; Mediorhychus orientalis; Capillaria sp., and Sternostoma tracheacolum (Smith 1973b). Many of the other parasites were recorded from particular hosts for the first time in Hawaii.

Some parasites undoubtedly have been in Hawaii for some time but have not previously been found due to a lack of research: for example, Plagiorhynchus charadrii, a common parasite of plovers, has been reported from the Golden Plover but not in Hawaii. Mediorhychus orientalis, another acanthocephalan, was first described in 1953 in Russia; it probably entered Hawaii in an introduced bird, but which bird and when is unknown. Syngamus trachea is common in a wide variety of birds and poultry, and probably came to Hawaii via the latter; gapeworm (probably S. trachea) was mentioned by Warner (1968) as being present in poultry. It is possible that Sternostoma tracheacolum, a common parasite in cage birds, was introduced to Hawaii via the estrildine finches. It was found only in estrildine finches in this study. The actual time of introduction of a parasite often is impossible to determine as many birds were not examined carefully when imported due to previously inadequate quarantine regulations.

The ability to survive in a variety of hosts characterizes several of the parasites encountered (i.e., Oxyspirura mansoni, Dispharynx, Syngamus trachea, and Sternostoma tracheacolum). The bird species often feed in the same areas and on the same kinds of

food, thereby facilitating the spread of such parasites. This phenomenon of interspecific transmission is an important consideration in an area such as Hawaii where parasites may reach new hosts for the first time. If the host has had no previous phylogenetic experience with the parasite, the consequences of infection may be particularly serious. Warner (1968) discussed some of the evidence implicating certain pathogens as important in the decline of the endemic Hawaiian avifauna. With the introduction of an appropriate mosquito vector, avian malaria and fowlpox presumably were able to spread throughout native bird populations and in the absense of natural resistance in the hosts, to have major effects on the survival and distribution of the endemic birds. Conceivably some of the internal parasites reported here could do harm in a similiar manner. Some of the species found in this study can be very pathogenic. Moreover, some of the introduced birds that might carry parasites already have ranges that overlap with the endemic birds. Obviously, all birds imported to Hawaii should be subjected to an effective quarantine in order to prevent the introduction of new parasites into the state.

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